WATER AND SEWAGE SURVEY

KUSK LAKE AREA

TOWN OF WALDEN

REGIONAL MUNICIPALITY OF SUDBURY

1984

Ontario
Ministry of the Environment

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Prepared by:

Ministry of the Environment
Northeastern Region
Sudbury, Ontario.

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1.0 Summary

At the request of the Regional Municipality of Sudbury, a survey of water and sewage systems was conducted in the Kusk Lake area in the Town of Walden, near Sudbury. This report discusses the results of that survey.

Of the 54 occupied residences in the area, 49 were surveyed. Results of chemical and bacteriological analyses were reported to the residents.

Listed below is a summary of the findings divided into health, aesthetic, and quantity considerations.

1.1 Health Considerations

1) Malfunctioning sewage systems - 13 problems of varying severity were investigated. Results from the survey indicate that many systems were not in conformity to present day standards. Further sewage related problems are likely should alterations be made to some of the septic systems in directing greywater discharge to the holding tanks rather than to the surface or a leaching pit.

2) A total of 14 (29%) well water supplies were bacterially contaminated at the time of the survey. After disinfection, correction was observed in only 4 (22%) of the contaminated supplies. Therefore, there appears to be a serious, ongoing contamination problem existing in at least 10 of the wells.

3) Six of the homes get their water from a surface water supply, from either the Vermillion River or Kusk Lake. None of the six systems provide water disinfection treatment and the samples from four systems showed bacterial contamination.

1.2 Aesthetic Considerations

1) Analysis of 47 individual water samples showed elevated levels in the following parameters: iron (55%), color (74%), turbidity (77%), manganese (68%), chloride (4%). Concentrations above the M.A.C. for turbidity can have an indirect effect on health.

1.3 Quantity Considerations

1) Water shortages were reported by 29% of the residents surveyed. Bacterial contamination was observed in 42% of those wells experiencing shortages.

2.0 Recommendations

1) All surface water supplies should be adequately disinfected.

2) Dug wells which showed quantitative and/or health related qualitative water problems should be corrected. The most desirable method of correction appears to be the drilling of new wells.

3) The area should be considered for assistance through the M.O.E. Small Systems Alternative Grant Program, for the correction of health and quantity related water supply problems and upgrading of sewage disposal systems where warranted.

3.0 Introduction

A water quality/quantity and sanitary survey of the Kusk Lake area was undertaken during the summer of 1982 by the Ministry of the Environment. It was initiated at the request of the Regional Municipality of Sudbury. Its purpose was to evaluate the water supply and sewage disposal systems in order to determine whether the area showed problems of sufficient severity and number to become eligible for assistance through the Ministry of the Environment Small Systems Alternative Program.

The Kusk Lake area is situated in the Town of Walden approximately five kilometers south of Whitefish on Highway 549. The defined survey boundaries, as determined in consultation with the Sudbury and District Health Unit and staff of the Town, extend from the Vermillion River on the north and along Highway 549 to Rat Creek in the south, including all the homes in the subdivision between the highway and Kusk Lake. The homes to the northwest along Grassy Lake Road to the intersection of Tower Road were also included, as well as one home situated immediately north of the Vermillion River. A plan of the area is shown in Appendix A.

3.1 Topography

Low bush areas with numerous rock outcrops are evident along the highway and to the east towards Kusk Lake. The topography becomes more rolling along Grassy Lake Road, to the west of the highway. Some of the area is cleared of trees but is no longer farmed.

The soil in the area is shallow consisting predominantly of clay of varying depth. Surface drainage is primarily towards Kusk Lake and the Vermillion River. Ditching along the highway and towards the Lake and River are the main drainage controlling devices. Natural drainage is poor due to flow disruptions by the numerous outcrops.

3.2 Survey Procedures

The field work began in late July and continued through to the middle of September, 1982.

The survey field work consisted of the following procedures:

1) A plan of the area was developed to catalogue every establishment.

2) A questionnaire form (see Appendix B) was completed with the aid of the owner or tenant at each home.

3) At the same time, samples of the drinking water were collected for bacteriological and physical/chemical analyses.

Bacteriological samples were forwarded to the Sudbury Ministry of Health Laboratory for coliform examination. Chemical samples were sent to the Ministry of the Environment Laboratory in Toronto. The chemical parameters for which analyses were requested were: sodium, iron, chlorides, manganese, hardness, alkalinity, color, turbidity, conductivity, pH, nitrate, sulphate. A few samples were also analyzed for copper, nickel, zinc, lead, cadmium, arsenic, cobalt and chromium in order to determine the characteristics of the area.

4) An inspection of each property was undertaken to determine the locations of the septic system and water supply. A search for evidence of malfunctioning sewage systems was also conducted.

5) Each lot was sketched to show the locations of the well(s) and sewage disposal system(s).

Residents whose bacteriological samples were submitted and found to exceed the Ministry of Health Criteria (<2, total coliform; 0, fecal coliform) were notified immediately of the contamination. At this time, occupants were advised to boil their water prior to consumption and were given instructions on how to disinfect their well. Once this had taken place, the field worker arranged to return to resample the supply in order to determine the effectiveness of the treatment.

A total of 65 establishments were found in the area. However, of these, four of the residences were not located within the survey boundaries and four were vacant. Two establishments were summer residences and thus were not surveyed. Field workers were unable to reach occupants of five other establishments. Only one resident did not wish to participate in the survey. Thus, a total of 49 residences were surveyed.

A list of the occupants/owners surveyed is provided in Appendix C, and their locations are shown in Appendix A.

4.0 Questionnaire Results

4.1 Sewage Disposal Systems

Appendix D summarizes the types and classes of the sewage disposal systems, as reported in interviews with the residents.

Thirty-nine establishments (80% of those surveyed) utilized septic tanks and field beds (Class 4 Systems). Two of these establishments had more than one septic tank included in their system. Seven of the homes (14%) were found to have holding tanks only (Class 5 Systems), while three (6%) establishments had outhouses or chemical toilets (Class 1).

Twenty-two percent of the sewage systems were reported to be five years of age or less, 31% between six and ten years of age, 8% were between 11 and 15 years of age, and 29% were greater than 15 years of age. The age of 10% of the systems was unknown.

At the time of the survey, problems were evident in 27% of the sewage systems. The sewage system problems identified are divided into three categories, based on various levels of severity, and graded accordingly. Category 1 systems include those systems whereby major structural deficiencies were evident, such as a corroded septic and/or holding tanks. Obvious sewage discharge to a ditch or to the surface is also included. The second category consists of observed cases with poor drainage, odours, or physical deficiencies. Minor springtime ponding, slow draining systems, etc. are placed in Category 3 and identified as being less frequent or serious.

As well, greywater discharge either to the surface or to a leaching pit was observed in 35% of the systems. These problems were considered separately and thus are not included in these categories.

Table 1 summarizes the number and category of problem systems found, or as were reported to the Ministry during the survey.

TABLE 1

Sewage System Problem Summary

Problem Category	No. of Problems	% of Total
1	5	10
2	7	14
3	1	2
No Problem	36	74
	49	100%

The Sudbury and District Health Unit was notified of all septic systems which were observed to be in non-compliance with M.O.E. regulations.

4.2 Water Supplies

The types and ages of the water supply systems utilized are summarized in Appendix E.

Twenty-five residents (51%) were found to use dug wells at an average depth of 7.3 m for their water supply. Drilled wells at an average depth of 47.2 m served 17 (35%) of the homes. One homeowner reported having no water supply. In this instance, water was pumped from a cistern which collected rain water. One system was shared. Six residents (12%) used surface water for their water

supply. None of the residences supplied by surface water was equipped with a disinfection unit, as recommended by this Ministry.

The majority of the dug wells were reported to be greater than 15 years of age while the majority of drilled wells were found to be under five years of age. In addition, it was determined that 29% of all the well water supplies were five years of age or less and that 29% were greater than 15 years. The ages of 7 (17%) of the well water supplies remain undetermined.

Appendix F summarizes questionnaire results relating to water supplies.

Of the 49 residents surveyed, 67% rated their water supplies as being good to excellent, while 31% rated the water quality as being fair to poor. The most common complaints were excessive iron (56%), hardness (50%), and poor taste (40%). Odour and color complaints were reported in 25% and 27% of the cases respectively. Four residents did not drink the water because of high iron concentrations, one, because of bacterial contamination and three boiled their water before consumption. Only seven of the residents utilized filtration for water treatment.

Quantity related complaints were reported by 14 (29%) of the residents. Regular, severe shortages occurred with 6 of the residents' water supplies. In these six cases, the supplies could

not meet the required normal household usage, on a regular basis during the summer and on an occasional basis during the winter. Four of the residents reported shortages only during dry summers, while four others reported that restrictive water management practices were necessary in order to maintain an adequate water supply all year round.

To summarize, although 31% had rated their water quality as satisfactory, generally, there was a high incidence of complaints (40% - 56%) related to aesthetic problems. In addition, 29% of the wells could not supply sufficient quantities of water on a regular basis.

5.0 Sample Analysis Results

5.1 Bacteriological Quality

Bacteriological analysis of the drinking water (46 samples) indicated that 18 (37%) of the supplies sampled had coliform counts above the Ministry of Health criteria of <2, total coliform, and 0 fecal coliform. Four of the contaminated supplies were surface water. In the initial sampling, all but two of the water supplies had fecal coliform, as well as total coliform counts.

Each resident was immediately notified regarding the bacterial contamination of their water supply and was advised to boil all drinking water until disinfection of the supply was undertaken. The Sudbury and District Health Unit was informed of all contaminated supplies.

5.2 Physical/Chemical Quality

Appendix G summarizes the exceedences of M.O.E. Drinking Water Objectives as found in the water samples analyzed.

The results indicate that 19 (40%) of the supplies have sodium concentrations in excess of the M.O.E. Notification Level of 20 mg/L.

Iron and manganese limits were exceeded in 55% and 68% of the supplies respectively. Turbidity exceeded M.O.E. Acceptable Maximum Concentration in 77% of the cases, while color was exceeded in 74% of the samples analyzed.

There were no reported exceedances in any of the samples analyzed for the following metals: copper, lead, zinc, cadmium, chromium, and arsenic.

6.0 Discussion

The sanitary survey, conducted during the summer of 1982, indicated few actual health problems with the sewage disposal systems in the survey area. However, many of the water supplies suffered from water shortages and bacterial contamination.

6.1 Sewage Disposal Systems

A total of 13 (27%) malfunctioning systems were found. Of these, five were of the Category 1 type, their condition being in a serious state of deterioration or disrepair. In one instance, an owner was found to have three septic tanks. One septic tank was corroded due to its advanced age (>20 years). The state of the other two tanks was uncertain as their actual location could not be determined. In another case, inspection of the system revealed that it consisted of a 45 gallon drum inserted into the ground for use as a holding tank. Two other septic systems were each found to have a pipe connected to a holding tank, and each was discharging to a gulley. One other resident had a system with a suspected leak in the pipe leading to the septic tank.

The other eight problems which comprised Categories 2 and 3 were considered moderate or less severe in nature. There were three reported cases of intermittent ponding of sewage and this was reported by the residents to occur mostly during the spring. One system was considered to be overloaded and one owner believed that

his system was slow to drain sinks,. etc. due to the small size of the holding tank. As well, two systems were found to experience odour problems and one owner complained of a drainage problem in the spring.

The Category 2 and 3 problems are attributed to improper drainage and overloading of the systems. In view of this, it is assumed that the latter would result in reduced efficiency during wet conditions thereby forcing the residents to reduce their water consumption or isolate the greywater to an area other than to the tank and field bed.

There were 17 (35%) cases of illegal greywater discharge to the ground surface or to a leaching pit. Although no health hazards were apparent, regulations require that greywater be discharged, not to ditches/ground surface but to an acceptable sewage disposal system. Discharge to a leaching pit is not acceptable for pressurized water systems. Showers, baths, washing machines and other water using appliances are required to be discharged to a septic tank, holding tank, or proprietary aerobic treatment (Class 6) system.

In general, the survey indicates that most dwellings appear to have satisfactory sewage disposal systems. However, considering the age of many of the systems (29% are greater than 15 years of age), further problems are likely. As well, if alterations are made to allow greywater discharge to the septic tank systems rather than to

the surface or a leaching pit, then a potential for overloading to the respective system exists, thus creating additional sewage disposal problems. Increased usage of water in other homes, should they become eligible for improvements to their water supplies if this program come into effect, must also be considered.

For the most part, the lots are large enough to accommodate the placement of a new Class 4 sewage system. In some locations however, where the lot sizes are smaller, rock outcrops are prevalent and when the existing systems become inadequate, there will be insufficient room to install a replacement system to meet today's standards. In these cases, the septic tanks and field beds may have to be replaced by holding tanks or proprietary aerobic treatment systems.

All of the aforementioned problems were referred to the Sudbury and District Health Unit.

6.2 Water Supplies

6.2.1 Bacteriological Quality

It was revealed that 18 (37%) supplies were bacterially contaminated at the time of the survey. Of these, twelve were dug wells, two were drilled wells, and four were surface water. All but two of the initial samples showed the presence of fecal coliforms.

Of the 12 (48%) bacterially contaminated dug wells, only 4 (16%) were corrected after disinfection of the water supply. Neither of the 2 (12%) contaminated drilled wells were corrected after disinfection. In all, 11 of the 18 bacterially contaminated supplies were resampled after disinfection and analysis showed correction in only 4 (22%) cases.

The presence of coliform bacteria is usually an indication of contamination by sewage or surface runoff. Fecal coliform bacteria are only found in the intestinal contents of warm blooded animals and their presence is considered to be an indication of sewage contamination. In most cases, the only sewage source, in close proximity to the wells, is a poorly functioning private sewage disposal system.

The average depth of the 12 contaminated dug wells was 5.8 m and the majority of these were found to be within 18.3 m of the septic tanks servicing the homes. Furthermore, over half of the homes with dug wells had septic systems ten years of age or greater. Thus, the shallow depths of the wells, their close proximity to the septic systems, and the advanced age of the majority of the septic systems, combined with poor soil conditions, further subtantiates the likelihood that the source of contamination is the private sewage disposal system.

The contamination in the two drilled wells may be due to an improperly installed well casing or seal which permits contaminated sub-surface water to enter the well. Proper sealing of the casing or use of water disinfection equipment could possibly rectify these situations and thus should be considered as corrective measures.

Surface waters are open to contamination by humans, animals and birds, all of which are potential carriers of disease. Thus, Ministry policy is that no surface water should be considered safe for human consumption, without prior treatment, including disinfection. None of the residents, who used surface water for their water supply, used disinfection units to treat their supply. All but two were found to be contaminated at the time of this survey.

To summarize, bacterial contamination was evident in many of the water supplies and was found to recur even after disinfection. Installation of a disinfection unit could possibly rectify this problem and should be considered. However, relocation of dug wells, to a distance of not less than 30 m from all private sewage disposal systems, is the preferred method of alleviating bacterial contamination. Since some of the lots are small, while others display rock outcrops, then a newly drilled well, cased to a minimum of 7 m and located 15 or more meters from sewage disposal systems should be considered.

6.2.2 Physical/Chemical Quality

Sodium concentrations were found to be elevated above the M.O.E. Notification Level in 19 (40%) of the water supplies. Six drilled wells (12%) and 13 dug wells (27%) were observed to exceed the Notification Level of 20 mg/L. Only two dug wells were found to have both high levels of sodium and chlorides and these were located along Highway 549 within 20 - 25 m of the highway. Road salting for winter road maintenance is likely to be the probable source of contamination in these cases. However, further investigation is required to confirm this relationship.

No maximum recommended limit for sodium has been established. However, high sodium concentrations can have an adverse effect on people already suffering from cardiac, renal, and circulatory problems. In cases of exceedences of 20 mg/L, the Medical Officer of Health is notified. As well, the residents concerned were notified of the water analysis results and were advised to consult their family physician should they require further information regarding the health implications of consuming water with sodium concentrations above 20 mg/L.

Table 2 summarizes the occurrence of aesthetic parameters above Ministry recommended limits and what the potential problems are for each parameter. Aesthetic parameters do not cause health problems although they can reduce the palatability of water when found in excess. The maximum levels are set according to the maximum tolerance of the general public, before an aesthetic problem may be perceived.

TABLE 2

Aesthetic Parameters

Exceedence of Maximum Desirable Concentrations

and Potential Effects

Parameter	M.O.E Criteria	% of Supplies Exceeding Criteria	Potential Water Quality Effects
Chloride	250 mg/L	4	Salty taste, may be corrosive to plumbing
Iron	0.3 mg/L	55	Rust or black stains on fixtures or laundry
Manganese	0.05 mg/L	68	Metallic taste
*Turbidity	1 Formazin Turbidity Unit (FTU)	77	Cloudy water
Color	5 True Color Units (TCU)	74	Self-explanatory
Sulphate	500 mg/L	-	Water may have a laxative effect

*Turbidity in water is caused by the presence of suspended matter such as clay or silt. Although the direct effect of this parameter is aesthetic, it is the only physical parameter for which a limit has been established on the basis of health considerations.

A maximum acceptable turbidity level of one turbidity unit (1 FTU) has been established on the basis that the most important health effect of turbidity in wells is its interference with disinfection and the maintenance of a chlorine residual.

Thirty-two (68%) and twenty-six (55%) of the water supplies contained manganese and iron levels above the maxium recommended limit of 0.05 mg/L and 0.03 mg/L respectively. Concentrations of iron and manganese exceeding these levels are not a health hazard but are a concern for aesthetic reasons in that they can produce an objectionable taste to the water as well as staining to fixtures and laundry.

Although the majority of the residents interviewed indicated there was a problem with iron in their water, 67% rated the general water quality as being good to excellent. Only four supplies prompted those residents to turn to alternate sources for their drinking water since their supplies were considered to be sufficiently unpalatable for cooking or drinking. Several methods are available which either remove or control the levels of these metals.

Turbidity and color are also aesthetically displeasing. Thirty-six (77%) supplies had excessive turbidity levels and thirty-five (74%) supplies had elevated color. Both of these parameters are due to a fine suspension of clay, silt or organic matter. Removal is possible through the use of filters.

6.2.3 Water Quantity

Water shortages were reported by 14 (29%) of the homeowners. Of the supplies which did not provide adequate quantities of water, the great majority (40%) were dug wells, while fewer (23%) of the drilled wells proved to be inadequate.

As well, half of the dug wells which experienced low water yield were observed to experience bacterial contamination while only one drilled well experienced the same.

The problem with the dug wells that suffered shortages is that there are few good locations for them due to the predominance of rock outcrops on some of the properties as well as the shallowness of the soil mantle. Further, the soil material is mostly clay which is of low permeability, thus limiting yield.

It was determined that the quantity problem prevalent in two of the drilled supplies was likely due to the type of pump installed. Use of a piston pump limits the depth from which water can be drawn from the well. Modifications to the pumping equipment would permit these wells to be drawn down further, thus utilizing their full storage capacity. One other drilled well was the source of supply for a private swimming pool. The complaint about insufficient water quantity from this drilled well may be due to the greater quantity requirements for the use of the swimming pool.

Thus it would appear that development of drilled wells into bedrock should be considered as a solution to provide adequate water quantities for normal household requirements.

7.0 Conclusions

1) A total of 18 (37%) residences were affected by bacterial contamination. As well, contamination was found to occur in 48% of all the dug wells.

2) Fourteen residences did not have a sufficient supply of water for normal household usage. A correlation existed between those wells experiencing quantity problems and those experiencing bacterial contamination.

3) The great majority of water quality and quantity problems were found to occur in dug wells. The most desirable corrective measure in most cases is the installation of a drilled well properly cased into bedrock.

4) A total of 13 (27%) malfunctioning sewage systems were reported. The potential for further problems exists however due to a number of factors. If an adequate water supply is provided to homes presently suffering from a shortage, a large increase in water usage could be expected. This, in conjunction with the rectification of greywater disposal procedures and the advanced age of many of the existing systems, could result in further sewage disposal problems.

8.0 List of Appendices

Appendix A: Kusk Lake Survey Area, 1982

Appendix B: Survey Questionnaire

Appendix C: List of Kusk Lake Survey Residents/Owners (Key to Appendix A)

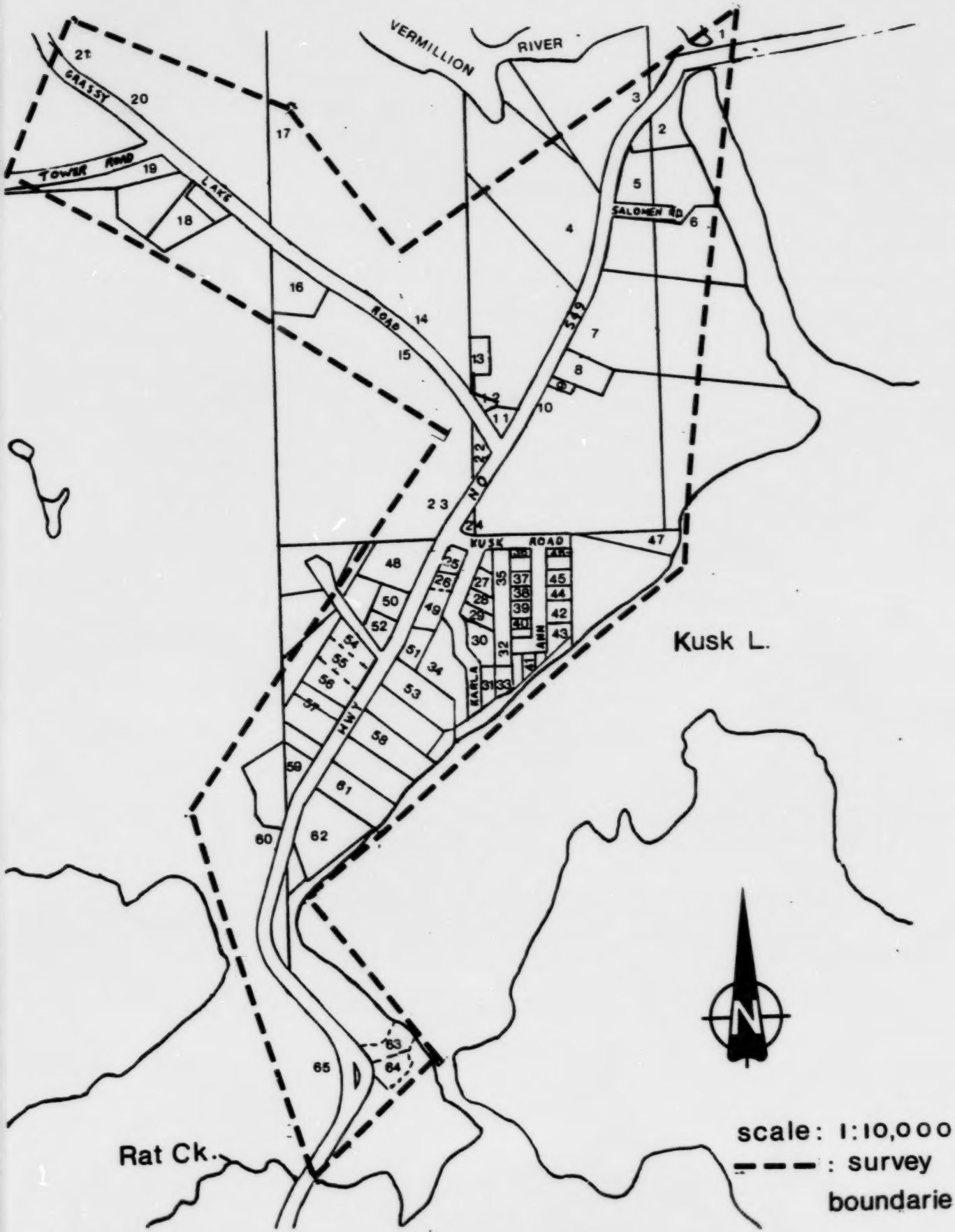
Appendix D: Information on Sewage Disposal Systems

Appendix E: Information on Water Supplies

Appendix F: Questionnaire Results for Water Supplies

Appendix G: Summary of Exceedences of M.O.E. Drinking Water Quality Objectives

Appendix A: KUSK LAKE SURVEY AREA



Date: _____

Survey No.: _____

Owner's Last Name: _____

Residence Location _____

Information Received from: _____

****

PROPERTY INFORMATION

Name of Owner: _____ Telephone No.: _____

Mailing Address: _____

****

Name of Resident: _____ Telephone No.: _____

Mailing Address: _____

****

Size of Lot: _____ No. of Residents: _____

Topography: _____ No. of Bedrooms: _____

Soil Type: _____ Laundry Facilities: _____

Other Water Consuming Devices: _____

Other Water Consuming Devices: _____

****

SEWAGE DISPOSAL SYSTEM

Type: _____ Age: _____ Tank Material: _____

Distance to Surface Water: _____ Water Supply: _____

Greywater Discharge: _____ Ponding Sewage: _____

Pump-outs _____ Previous Problems: _____

****

WATER SUPPLY

Type: _____ Depth: _____ Age: _____

Ever Disinfected: _____ Chlorinator: _____

Filtration (type): _____ Ever Changed: _____

Pump Type: Submersible ___ Piston ___ Jet ___

Previous Water Sample Taken: ___ When: _____ Results: _____

Any history of recurring health problems from drinking the water _____

_____ Examined by Doctor _____

****

CONSUMER COMPLAINTS

Taste _____ Odour _____ Hardness _____

Colour _____ Iron _____ Quantity _____

Quality _____

****

COMMENTS: _____

_____

_____

Surveyed by: _____

DIAGRAM ON REVERSE SIDE SHOWING LOCATION AND DISTANCES

APPENDIX C

List of Kusk Lake Survey Residents/Owners

Survey #	Resident/Owner
K-1	O. Svensk
K-2	R. Hughes
K-3	R. Hotti
K-4	J. McNeil
K-5	V. Hreljac
K-6	E. Niemi
K-7	E. Salminen
K-8	Penage Lake Community Centre - not surveyed
K-9	J. Schiller
K-10	P. Salminen
K-11	E. Bulloch/H. Keranen
K-12	D. Whitman
K-13	D. Kilbey
K-14	T. Little/V. Mannila
K-15	A. Etula
K-16	Vacant/A. Etula
K-17	not included in survey area
K-18	R. Lively
K-19	W. M. Lahti
K-20	not included in survey area
K-21	not included in survey area
K-22	K. Sagle
K-23	P. Briar/A. Etula
K-24	G. McKinley
K-25	O. Maki
K-26	Vacant/O. Maki
K-27	J. Lampi
K-28	D. Heise
K-29	not surveyed
K-30	J. Pilbacka
K-31	H. Keranen/R. Roiha
K-32	R. Smith/R. Roiha
K-33	E. Nurmi
K-34	summer residence
K-35	C. Boomhower
K-36	R. Cousineau
K-37	R. Selle
K-38	B. Whalen
K-39	A. Denis
K-40	E. Crewson
K-41	D. Voth
K-42	Summer Residence
K-43	H. Ijas
K-44	Not Surveyed
K-45	B. Laframboise

K-46	D. Beaudoin
K-47	K. Moxam
K-48	D. Morrell
K-49	T. Saikkonen
K-50	R. Schiller
K-51	vacant
K-52	H. Babcock
K-53	W. Komsa
K-54	Vacant
K-55	I. Gauthier/A. Etula
K-56	T. Turbitt/K. Holly
K-57	T. Beynon
K-58	not included in survey area
K-59	not surveyed
K-60	R. Saikkonen
K-61	E. Routledge/A. Etula
K-62	V. Saikkonen/A. Etula
K-63	not surveyed
K-64	refused to participate
K-65	D. Viau

Summary

Total number of Catalogued Establishments/Structures	65
No. of Vacant Establishments	4
No. of Summer Residences Not Included in Survey	2
No. Out of Survey Boundaries	4
No. Not Reached	5
No. Refusals to Participate in Survey	1
Total No. of Residents Included in Survey	49

APPENDIX D-

Information on Sewage Disposal Systems

Type		Totals
Class 1		3
Class 4		
	Metal Construction	12
	Concrete Construction	23
	Unknown Construction	4
Class 5		
	Metal Construction	4
	Concrete Construction	2
	Unknown Construction	1
		49

Age	Unknown	<1	1-5	6-10	11-15	>15
Class 1	2	1	-	-	-	-
Class 4	3	2	7	11	4	12
Class 5	-	1	-	4	-	2

Greywater Discharge

To Surface	-	12
To Leaching Pit	-	5

APPENDIX E

Information on Water Supplies

Type	No.	%	Avg. Depth(m)	Bacteriological Contamination	
				No.	%
Dug Well	25	51	7.45	12	25
Drilled Well	17	35	47.2	2	4
Surface Water	6	12		4	8
No Supply	1	2		-	-
TOTAL	49	100		18	37

Age of Wells

	0-5	6-10	11-15	>15	Unknown
Dug	2	2	4	12	5
Drilled	10	3	2	-	2

APPENDIX F

Consumer Water Quality Complaints

Aesthetics		No.	%
Taste		19	40
Odour		12	25
Colour		13	27
Hardness		24	50
Iron		27	56
Overall Quality Rating:	Excellent-Good	32	67
	Fair-Poor	15	31
	No comment	1	2

Quantity	No.	%
Regular Severe Shortage	6	13
Dry Summer Shortage	4	8
Careful Water Management	4	8
Total Quantity Related Complaints	14	29

Water Treatment Utilized

	No.
Filter	7
Boil	3
Total	10

APPENDIX G

Summary of Exceedences of M.O.E. Drinking Water Quality Objectives

Parameters with Established Limits	M.O.E. Drinking Water Quality Objectives	Supplies Exceeding Criteria No.	%
Iron	0.3 mg/L	26	55
Chloride	250 mg/L	2	4
Color	5 True Color Units (TCU)	35	74
Turbidity	1 Formazin Unit (FTU)	36	77
pH [1]	6.5-8.5	-	-
Sodium	20 mg/L	19	40
Manganese	0.05 mg/L	32	68
Nitrate	10 mg/L	0	-
Sulphate	500 mg/L	0	-
Fluoride	2.4 mg/L	0	-
Copper	1.0 mg/L	0	-
Zinc	5.0 mg/L	0	-
Chromium	0.05 mg/L	0	-
Cadmium	0.005 mg/L	0	-
Lead	0.05 mg/L	0	-
Arsenic[2]	0.025 mg/L	0	-

[1]Notification Level

[2]Northeastern Region Correction Level

*The percentage values are tabulated on the basis of the 47 water samples that were analyzed.

GLOSSARY OF CHEMICAL TERMS

1. Alkalinity

Alkalinity is the measure of the power of a solution to neutralize hydrogen ions. It is used to define the buffering capacity (the capacity to resist changes in pH) of water. It is the result of the presence of carbonates, bicarbonates, and hydroxides. It is generally associated with high pH values and hardness and is expressed in terms of an equivalent amount of calcium carbonate. Alkalinity is not considered detrimental to human health.

2. Colour - Apparent

Apparent colour includes colour due to dissolved solids and suspended matter. In groundwaters colour is usually due to the presence of iron, manganese or dissolved organic matter. Most naturally coloured water (usually yellowish-brown) is harmless.

3. Chloride

Chloride concentrations in water supplies may result from contact with minerals, industrial and agricultural wastes, or human and animal sewage. Land drainage often contains high concentrations of chloride in the winter due to the

application of road salt. Chlorides are not harmful, but do produce a salty taste. The allowable concentration in drinking water is based on taste rather than on health considerations.

4. Conductivity

Conductivity is defined as the reciprocal of a water's electrical resistance. It is a measure of the ion concentration in water. In natural waters, conductivity is mainly due to calcium, magnesium, sodium, potassium, bicarbonate, chloride, sulfate, and nitrate ions. It is not considered a health hazard.

5. Hardness

Hardness is traditionally a measure of the soap neutralizing power of water, expressed in terms of an equivalent concentration of calcium carbonate. Hardness is mainly attributable to the presence of calcium and magnesium ions resulting from the natural accumulation of salts during contact with soil and geological formations. Excessive hardness (>200) is considered objectionable because it reduces the efficiency of soap and it can also produce scums on water surfaces and cause clogging in the plumbing system.

6. Iron

Iron is the most abundant of the heavy metals found in nature but despite this abundance it is generally found in relatively low concentrations in uncontaminated surface waters. In groundwater, however, conditions may be such that high concentrations of iron remain in solution. Iron concentrations occur in water due to the leaching of soluble iron salts from soil and rocks. Iron is non-toxic even at high concentrations but becomes objectionable because of the taste, odour and colour it imparts to the water. It also tends to stain laundry and porcelain plumbing fixtures. Ferric iron can combine with the tannin in tea to produce a dark violet colour.

7. Manganese

Manganese is a common element in nature and found in numerous minerals. It is essential in trace quantities for the proper nutrition of both plants and animals. Manganese is non-toxic at levels encountered in water supplies. It can cause unpleasant tastes and stain laundry and plumbing fixtures. Iron and manganese are commonly found together.

8. Nitrate Nitrogen

Nitrates are the end products of the oxidation of organic nitrogen and as such they occur in polluted waters that have undergone self-purification. They can occur in groundwater as a result of seepage from sub surface sewage disposal systems or leaching of fertilized soil. Although nitrates are considered non-toxic to adults, high levels (in excess of 10 mg/L) in domestic water supplies, can lead to a condition known as infant methemoglobinemia in which the oxygen carrying capacity of the blood is inhibited. This illness is most prevalent in children under the age of 3 months and possibly in pregnant women.

If nitrates are above the recommended limit and family members are within the age groups and conditions mentioned above, the consumer should contact his/her family physician.

9. pH

pH is a parameter which expresses the basicity or acidity of a solution. There is no direct health effect on which to base limites for the pH of drinking water. A pH of 7 is neutral, water of high pH (above 8.5) is considered basic and may cause incrustations in pipes and plumbing fixtures. Water of low pH (below 6.5) is considered acid and may cause metal corrosion of pipes. The recommended limits (6.5 - 8.5) for drinking water are thus devised to reduce these processes.

10. Sodium

Sodium ranks sixth in the natural order of elemental abundance and is normally the principal ion in brackish or saline groundwater. It is important for all life forms and is generally considered non-toxic. Patients with renal, cardiac and circulatory problems however are usually warned to avoid the consumption of water containing high concentrations of sodium. Waters softened by the ion-exchange process, employed in most domestic water softening equipment, generally contain high levels of sodium.

11. Sulphates

Sulphates occur naturally in water as a result of leachings from minerals and biological processes. Water high in sulphates tends to form hard scales on plumbing and increase the corrosiveness of water towards concrete. Under certain conditions high sulphates may promote a non toxic bacterial growth which converts the sulphate ion to hydrogen sulphide gas imparting rotten egg smell to the water. Concentrations which exceed the recommended limit may exert an effect similar to a laxative on the gastro-intestinal tract.

12. Turbidity

Turbidity is caused by suspended matter which diminishes the the penetration of light and makes the water appear cloudy. It is an aesthetic parameters and not usually associated with health related problems. However, excessive turbidity can interfere with dissinfection processes, especially when using chlorine compounds as the disinfectant. In Ontario, turbidity is measured in Formazin Units.

13. Fluoride

Fluorides occur naturally in minerals and soils and are thus present in varying concentrations in well water. Trace amounts of fluorides present in drinking water provide a substantial protection from dental cavities, especially for children. Fluoride levels much in excess of the recommended limits may lead to mottling of teeth. The limit has been set on the basis of these enamel effects.

CJL/cc/G-R15